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Rendezvous

Where today meets tomorrow

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Then and Now

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TRANSITION & Retirement

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PICTURED ABOVE: The Launch Control Center during Apollo 8 launch activities at Kennedy Space Center (1968).

Transition

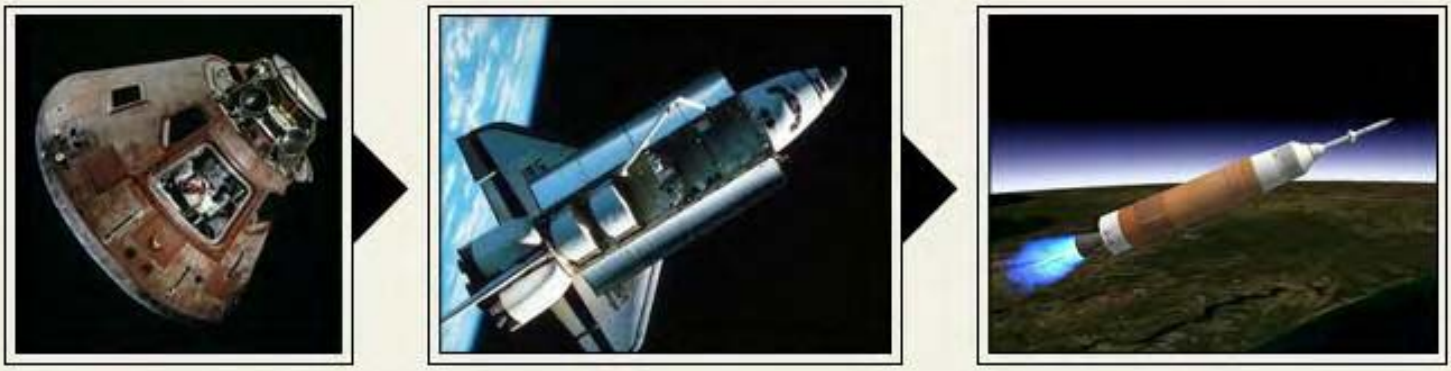
Then and Now

Change

is always difficult, but healthy.

The last time the agency designed and developed a new human-rated spacecraft was almost 35 years ago. This means that to an overwhelming majority of the extended human space flight family, this transition between the shuttle program and Constellation is an all-new experience filled with change and, understandably, a fair amount of apprehension.

History tells us that the best way to avoid making mistakes in the future is to study the lessons of the past. With that in mind, Rendezvous sought out space program veterans still with NASA who worked through the last transition. At Johnson Space Center, we spoke with Jerry Goodman, Joe Kosmo and Mack Henderson. At Marshall Space Flight Center, we spent time with George Young, John Cole and Everett Runkle. And, Ed McCaskey contributed from Kennedy Space Center. We know that there are many more space program veterans out there, and we would like to hear your reflections on transitions past and present. Please feel free to use the feedback button at the end of the article to share your memories and advice for the journey that lies ahead.



Three dominant themes rose to the surface when Rendezvous asked space program veterans to compare transitions between the Apollo and Space Shuttle Programs and between the Shuttle and Constellation Programs. When asked what they remembered about the last transition and their thoughts on the current one, they focused on the differences, a few similarities and a wealth of opportunities.

More Differences than Similarities

Joe Kosmo recalled how things were very different back in the early 1970s.

"A lot of folks just left after Apollo," Kosmo said. "It seemed to a lot of us that the country lost its space vision – or maybe its space ambition."

The development of the shuttle as a service vehicle for the International Space Station didn't seem to have the appeal of the Apollo moon missions, he recalled.

Another difference was the U.S. military's role in the development of the shuttle requirements. In fact, the dimensions of the shuttle's payload bay were dictated by the U.S. Air Force. Kosmo also noted that the current transition seems more complicated with current leadership and the workforce operating three parallel programs simultaneously with no additional funding.

“There was a lot of confusion...”

Pictured above: A Saturn rocket at Launch Pad 39 at Kennedy Space Center.

"There was a lot of confusion facing the agency between Apollo and Shuttle, like there is now between Shuttle and Constellation," Kosmo said. "But I think it was worse back then. There was no announced future, no real vision for our participation in space exploration like there is now."

George Young remembered that he was fresh out of school and working on Saturn at the end of Apollo. There were some layoffs, and times were lean at Marshall in the 1970s. The transition was difficult, if not traumatic, for NASA and the surrounding communities. Back then, it seemed that the mainstream programs were more tightly focused in specific centers. Today, however, the work is conducted in collaboration with other centers and utilizes a broader base of capabilities and expertise. This, he believes, is a good thing – as long as Agency objectives are held above local and personal agendas.

"You have to remember that change is healthy, but it's also uncomfortable for those who are in the middle of it," Young observed. "But, today there's a lot more knowledge sharing, collaboration on objectives and sharing of resources."

"Rumors abounded ... that they were just going to walk away from the launch pads at KSC."

Ed McCaskey remembered the transition from Apollo to Shuttle clearly, but from the perspective of Florida's Space Coast.

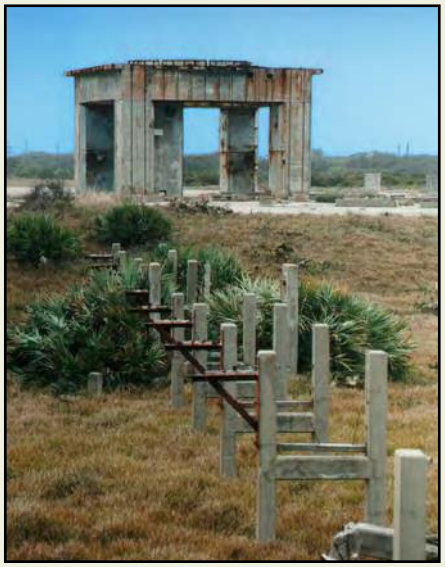
"There was definitely an aura of uncertainty," McCaskey said. "A contributing factor was the competition for the launch site. Rumors abounded that Matagorda Island on the Texas Gulf Coast was a leading competitor and that 'they' were just going to walk away from the pads at KSC. Abandon in place. Add to that the poor condition of the local real estate market in Florida at the time. People were walking out on their mortgages, and whole neighborhoods began to suffer. People left to take jobs outside the space program entirely."

McCaskey also remembered that they were told what was happening and when it would happen as much as reasonably possible, but it seemed to some that *Aviation Week* and the local newspapers were always one step ahead.

"Sometimes leadership would have group meetings and send out center-wide mailings to try to keep us informed," McCaskey noted. "But, mostly they tried to keep us focused on the forthcoming first shuttle launch." The roadmap that existed for the transition was more of a view from 20,000 feet. They had a general idea of where they were headed, but the individual milestones along the way were largely left to the individual to determine.

In McCaskey's view, another key difference between the two transitions was the state of technology.

"Back then, we didn't sit in front of computers all day," McCaskey said. "We were out in the field with the contractors and the hardware, developing more of a 'hands-on' knowledge and relationship with our work."



Pictured above: Apollo 1 Launch Pad 34 then and now

In the absence of continual communication from the top, was there more rumor mongering at the workforce level? McCaskey doesn't know, but he observed back then that morale within the program was also suffering because several prominent legislators in D.C. were trying to cut NASA's budget either partially or entirely.
"That just added to the uncertainty," he noted.

"... everything flowed from Explorer to Mercury to Gemini to Apollo"

But, the mood of the agency wasn't completely gray. Mack Henderson remembered that there was a lot of national support, and the workforce felt they had real choices ahead of them. He remarked that although they didn't know how big the gap would get, they still didn't have a big uncertainty factor.

"What's different about the various transitions is that everything flowed from Explorer to Mercury to Gemini to Apollo," Henderson said. "No one was really worried about what was coming."

Henderson also noted that the attitude of the nation is different now.

"The country just isn't as supportive as it was through the Apollo years," Henderson said. "Interest in space seems to be waning. People don't seem to be relating to the importance of the space program or aware of the benefits it provides."

However, he does think that people still get excited about a human presence in space.

Everett Runkle saw a big difference in how the Shuttle-Constellation transition is being handled today. He remembers that the mood was pretty grim in Huntsville during the transition from Apollo to Shuttle. Everyone was downsizing at the time — Boeing, Northrop, even IBM.

"They were laying off 2,000 to 2,500 people. In the end there were only about 500 of us left," Runkle said.

> "... we knew what was going on after the fact."

As far as workers knew, Runkle said, there was no roadmap from Apollo to shuttle.

"We weren't told much, but we were all reading the newspapers, so we knew what was going on after the fact," Runkle said. He thinks two key differences today are that leadership is striving to keep the workforce informed from a project level and that the transition schedule is well known.

Opportunity Is Knocking

Kosmo suggested that it will take everyone pulling together to get the job done, and the operative attitude should be perseverance.

"There is the long-range goal that we should keep in focus," he said. "Just go with the flow, stay the course and build on your technology base."

> "In the end, many of the same skills will be required on Constellation."

Young had similar advice.

"The agency has to get through the development phase of Constellation first, so it's important for us to be positioned for what's next and prepare for a different kind of work," Young said.

In the end, he said, many of the same basic skills used on the space shuttle will be required by Constellation, so this transition could be viewed by many in the workforce as an opportunity.

"You have to make your own destiny," he continued. "This is an opportunity to broaden your skills, accept a learning environment and make yourself valuable to the program."

Young and Kosmo could give that advice because they've been there. At the end of Apollo, Kosmo did not abandon his work on the advanced spacesuit or his expertise in life support systems. Instead, he leveraged it to the shuttle program and played a part in the evolution of the next generation of human space flight. Young became involved in the analysis and development of the Space Shuttle Main Engine.

“There’s a lot of great work to be done.”

Pictured above: Werner Von Braun in front of Apollo 11 at launch pad at Kennedy Space Center.

John Cole has also spent his career successfully transitioning. He remembers being involved in an Apollo discussion that focused in on whether the program should pursue Earth orbit or lunar orbit rendezvous – heady stuff for a kid fresh out of Auburn and working on the inertial navigation system. He also made a presentation to Werner Von Braun and worked on the navigation system for the space tug and the reusable orbital transport concept that eventually became the shuttle.

His advice was simple.

"Our management believes that this is the right approach and that there's a lot of great work to be done," Cole said. "So find a way to contribute and enjoy your work." McCaskey's advice resonated with the wisdom of someone who has "been there." He suggested that we look forward to the Constellation Program.

“... become an invaluable asset to both the shuttle and Constellation programs ...”

"Try to become an invaluable asset to both the shuttle and the Constellation programs by learning the disciplines needed by both," McCaskey said. "But, set aside several months' salary so you can ride out a dry spell if necessary."

As a program veteran now working in the shuttle program transition office and taking a decidedly hands-on approach, Henderson's advice is concise, direct and informed.

"Work hard and keep doing what you're supposed to be doing," he said.

Runkle had a distinctly Marshall-centered point of view.

"If you're a contractor to NASA at Marshall and want to move to the new program, get ready now," he said. "Don't wait. If you're a civil servant, Marshall will have plenty of work to do, but be as flexible as you can because things can and will change. If you're new to the space program, you're in the best position of all. There's a lot of excitement in your future."

“... broaden your experience base ...”

During the Apollo-Shuttle transition, Jerry Goodman built on his skills and expertise by going back to college to earn his masters' degree.

"Space engineering is extremely broad," Jerry Goodman said. "There are plenty of ways to diversify and lots of opportunities ahead. I believe that if you broaden your experience base, not only do you have a better perspective on what's in front of you, but you gain a better idea of what choices to make."

The best thing you can do is make yourself valuable to the program, he advises.

Young's "advice" was pretty simple: Realize that you're here to do the agency's job and that the NASA mission is continually evolving.

In the end, transition is never easy. It helps, though, to have an exciting future and ambitious goals in front of us.

Jerry Goodman, senior technical expert in habitability and environmental factors, worked on the Apollo space suit, in the Apollo Program Office, on the Apollo command module and lunar module and on space shuttle selection. Today, he supports Constellation reviews, serves on expert panels and advises on different areas that pertain to his experience on the Apollo, Space Shuttle and International Space Station Programs. He also teaches at University of Houston-Clear Lake, has authored several chapters in books about acoustics and is currently working on a book of his own.

Joe Kosmo, senior project engineer, has worked on every American spacesuit since the Gemini program and also spent five years working on the requirements for the shuttle's life support systems. He started and continues to lead the Desert RATS – or Research and Technology Studies – project, which tests prototype systems in Mars- or lunar-like settings to further develop enhancements for the future. He also continues to work on suit development in an advisory capacity.

Mack Henderson, aerospace engineer, can barely remember a time when he was not working on aeronautics and human space flight in some capacity. As early as 1960 he was already working on aeroballistics for the Saturn V at Marshall. Four years later, after finishing his degree at Virginia Tech, he came to work in Houston at the Manned Space Flight Center, now known as Johnson Space Center. He worked in mission planning for Gemini and Apollo and in the trajectory group on launch abort planning. Today, he works for the Transition Management Office in the Space Shuttle Program, while also supporting the Constellation Program Review Board on any SSP needs and continuing to work on advanced planning for operational improvements for shuttle and future programs.

George Young, manager of the Exploration Advanced Capabilities Office, was working on the Saturn rocket system at the end of the Apollo program. Today, the projects he oversees include the Exploration Technology Development Program, In-situ Resource Utilization, In-situ Fabrication and Repair, Automated Rendezvous and Docking, Radiation Hardened Electronics, Cryogenic Fluid Management, Advanced Life Support and Deep Throttling Engine, among others.

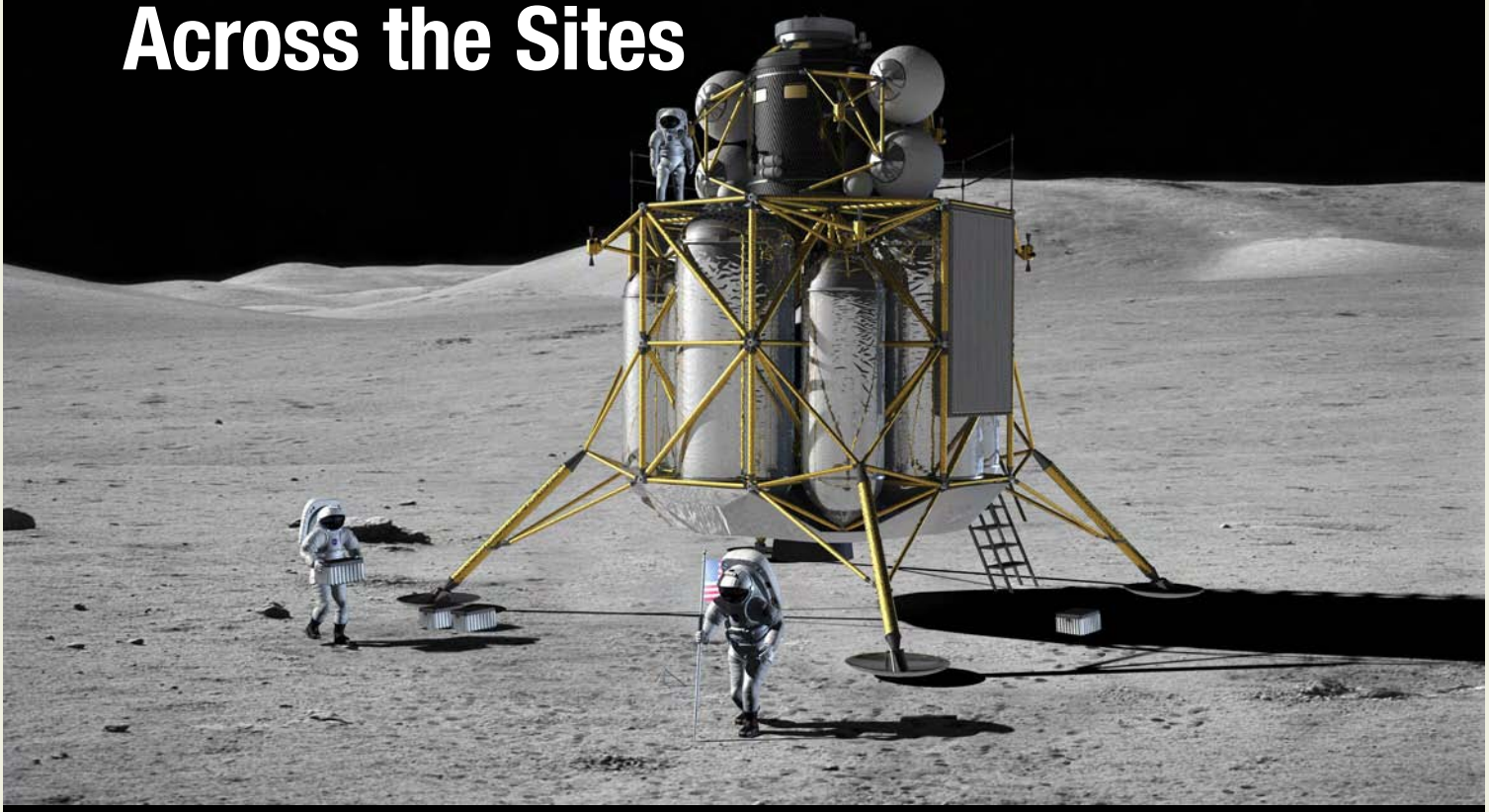
John Cole, aerospace engineer, has been involved with the space program in one role or another since 1962 and has worked on Apollo, pre-Shuttle concepts, the Shuttle, the International Space Station (at NASA headquarters), the X-34 and on the Space Exploration Initiative at Marshall. Today, he is working with Vehicle Systems Engineering, specifically on risk management for Ares I-X, Ares I-Y, Integrated Vehicle Ground Vibration testing and the Launch Abort System, among other tasks.

Everett Runkle, aerospace engineer, was working for Chrysler at Marshall on the contractor side of the house during the transition between Apollo and Shuttle. Today, he is involved in the review of space shuttle main engine tests and planning for future main engine tests.

Ed McCaskey, senior LOX cyrogenic propulsion engineer on KSC's Space Shuttle launch team has been involved in the space program since 1963, first working for Honeywell in St. Petersburg, Fla., on the design and development of the inertial guidance systems for the Gemini capsule and the Centaur upper stage of the Atlas/Centaur vehicle. Invited to work on the Apollo Program, 1967 found him at pad 37 at the Cape Canaveral Air Force Station. Since then, McCaskey has worked on the Apollo, Apollo-Soyuz, Skylab and the Space Shuttle Program. Today, he oversees operations involving the loading of liquid oxygen (LOX) from the Firing Control Center and, with the console team, monitors the Launch Commit Criteria. He also oversees the cryogenic design and modification of Launch Pads 39 A and B and Mobile Launchers 1,2 and 3.

T&R

Across the Sites



With the Shuttle's accelerated launch flow and Constellation activities springing up at centers across the country, we are all busier than we've been since Return To Flight. Rendezvous understands and appreciates these time pressures. So, because many of us don't have the spare time to stay abreast of what's happening outside our immediate work parameters, here's a progress report of the transition (and some retirement) activities taking place in centers and sites across the country.

Module on the Move

The Orion crew module simulator left Langley Research Center in Hampton, Va., early in March and is now in Edwards, Calif., at Dryden Flight Research Center for a six-month stay. The crew module simulator is scheduled to ship to the White Sands Missile Range in New Mexico on October 2, 2008, to begin launch abort systems tests. Because Orion will be carrying astronauts to the moon and back, as well as to the International Space Station, teams are using the utmost care and precision in fabricating and equipping these first flight test articles.

The 16.5-foot diameter cone-shaped capsule is a shining example of teamwork at NASA. The structural shell was designed and fabricated at Langley. The simulator and some Langley personnel are now at Dryden working alongside a support team that also includes a NASA crew from White Sands Test Facility in Las Cruces, NM. The Orion Project launch abort system team and the abort flight test team is comprised of personnel from NASA's Marshall Space Flight Center, Johnson Space Center and Glenn Research Center, as well as contractors from Lockheed Martin and Orbital Sciences Corp. After assembly the module will be sent to New Mexico where the White Sands team will support the launch abort tests taking place at the neighboring missile range.

Pictured above: Two views of the Orion command model prototype or simulator at NASA's Langley Research Center.

> **"The 16.5-foot diameter cone-shaped capsule is a shining example of teamwork at NASA."**

Dryden is the final clearinghouse for all of the capsule's components, and for the next six months crews will organize and assemble all the systems designed to work within the structure. This includes the computers, electronics and instrumentation. Recently, Dryden has taken on at least six additional tasks to get the simulator ready for the October tests, including painting the module the weekend it arrived. For the duration of the assembly, Dryden will be running two 12-hour shifts around the clock. Five years ago, Dryden and White Sands had almost no interaction – now, White Sands has assigned seven full-time crewmembers to support Dryden during this period.

Dryden is also helping to bridge gaps in training between centers. With the help of White Sands, Dryden is beginning to manage a training database that will help to ensure that personnel can transfer training and qualifications from one site to another. As NASA personnel from centers around the country continue to work together on flying out and retiring shuttle and transitioning to new Constellation programs, it will become more important than ever for teams to be able to seamlessly move from one center to another to support Constellation activities.

An SUV in Space

Last fall, NASA's lunar architects tasked the Automation, Robotics and Simulation Division at Johnson Space Center with building a new concept vehicle for use on the moon. The Exploration Technology Development Program at NASA's Langley Research Center in Hampton, Va., sponsored the vehicle's development. In late February, the new concept vehicle – a low-riding lunar truck – was taken out on the grass at Johnson Space Center for a test drive.

-Pictured above: Models of the new concept vehicle for use on the moon.

Given just a few basic requirements and then told to throw away assumptions based on previously used rovers, the design team had to come up with a set of almost completely new ideas. So, with assumptions out the window, the team utilized the lessons learned from the Apollo era and Mars rovers to create a prototype vehicle with six wheels – each with its own individual pivot steering, or crab steering. The Mars rovers showed that even with one wheel out of commission the vehicle could still operate on the remaining five, and the "all-ways, all-wheels" steering means no reversing is required and steep slopes could be navigated sideways instead of head-first.

Because the vehicle can move in all directions, the driver must be able to as well. To operate the rover, the driver stands in a perch that can also pivot 360 degrees. The rover can even lower its carriage to the ground to ease the climb on and off for the astronauts in space suits, and individual wheels or sections can also be adjusted to keep the vehicle level when crawling across the uneven surface of the moon. In fact, in agility and appearance the rover vaguely resembles a giant insect, or crab.

> "... the design team had to come up with a set of almost completely new ideas."

NASA will be able to pull elements from this prototype, along with elements from alternate designs, to create the final design for the rover that will be used on the moon in the not too distant future.

Giving Old Engines and Systems New Life

Ares' roll control system was in the spotlight at Kennedy Space Center earlier this year. Engineers and technicians have been involved in a series of studies and tests in preparation for Ares' first test launch scheduled for a year from now. The most current round of testing at Kennedy focused on procedures that will be used to safely handle and load propellant tanks for the roll control system.

Results included some adjustments to the ground support equipment, and the test of the propellant system components, including the helium tanks and titanium tanks, went well. As an added safety, the tests were performed with water rather than the hazardous hypergolic fuel and oxidizer that will ultimately be used.

This most recent round of testing combined elements from the Air Force Peacekeeper missile and support equipment originally designed for use on shuttle. The thrusters on Ares' roll control system turn after liftoff to ensure the rocket is on the proper heading. The thruster system used for the test comes from parts of decommissioned Peacekeeper missiles. The Peacekeeper is also being used elsewhere in the Constellation Program. Currently, engineers at NASA's White Sands Test Facility are testing the Peacekeeper's engine to see if they can find a new use on Ares. Glenn Research Center is also using Peacekeeper engines for potential upgrades in the Orion programs.

Pictured above: Components of the J-2X engine being installed on the A-1 Test Stand at Stennis.

Word on the Stand

News from NASA's Stennis Space Center includes the results of the first hot-fire test of the J-2X's Powerpack 1A gas generator. The test took place at Stennis on Jan. 31, 2008, and is one of a series of twelve that began last fall at Stennis. The first – a chill test – took place in December and the Jan. 31 test marked the first hot-fire test in the series. The test was designed as a 3.42-second helium spin start with gas generator ignition. The test ran the full scheduled duration with a smooth start and normal shutdown.

Staying on the Sea of Tranquility

Pictured above: The Altair lunar lander (artist's rendering).

It is easy to forget that the Constellation Program is more than just Ares and Orion. The Altair lunar lander does not have quite the profile of the other vehicles – yet. In fact, the name "Altair" was only announced in December 2007. Named for the 12th brightest star in the night sky (and the brightest in the constellation Aquilla), the Altair lunar lander will eventually land four astronauts on the moon. Altair will launch aboard an Ares V rocket into low Earth orbit, where it will rendezvous with Orion. It will be capable of providing life support and a home base for weeklong lunar surface exploration missions and then returning the astronauts back to Orion.

In March, NASA announced its selection of five space-related companies to evaluate the lunar lander design concepts. Andrews Space of Seattle, The Boeing Company of Houston, Lockheed Martin Space Systems Company of Denver, Northrop Grumman Corporation of El Segundo, Calif., and Odyssey Space Research of Houston were each awarded contracts for a 210-day study in which they will provide an independent study of NASA's in-house design concept. Their studies will include proposed safety improvements and recommended industry-government partnering arrangements. The five awards total about $1.5 million, with a maximum individual award of $350,000.

NASA Road Trip

Pictured above: The Ares 1-X Upper Stage Mass Simulator super segment assembly stand at Glenn Reaserch Center

Space travel starts with a car. Or in this case, a very large truck. Employees at Glenn Research Center in Cleveland have been hard at work manufacturing the Ares I-X Upper Stage Simulator hardware. In September, all 11 segments are to be delivered to the Vehicle Assembly Building at Kennedy Space Center. Though the segments will make the majority of the trip to Port Canaveral by boat, they'll travel over land to reach an Ohio River port.

And so, at the end of January, part of Ares took a road trip. The Ares I-X USS Pathfinder 2 segment was covered and outfitted with six data loggers to determine potential shock to the load. The 130-mile round trip took about three hours, and was conducted to evaluate all the processes involved and to obtain the shock data.

Each of the 11 segments is 16- to 18-feet in diameter, 10-feet tall and weigh up to 60,000 pounds. Glenn organizations are working together to develop and execute the transportation plan.

Reduce, Reuse, Recycle

Last August, NASA released a draft environmental impact statement on potential environmental impacts associated with the Constellation Program. Now, it's Shuttle's turn.

In February, NASA prepared the Draft Space Shuttle Program Programmatic Environmental Assessment, a report to address the potential environmental impacts associated with the transition and retirement of the shuttle program. The transition and retirement of the shuttle is three-fold: the real property (land, buildings, structures, built-in systems, hardware), the personal property (all assets not classified as "real property" owned by, leased to or acquired by the government) and the people of the program themselves. Because it is the real and personal property that has the greatest potential for environmental impacts, this report focuses on the property disposition activity as related to transition and retirement.

Like the Draft Programmatic Environmental Impact Statement on the Constellation Program, this shuttle report was required by the National Environmental Policy Act, which requires federal agencies to prepare an environmental impact statement for major federal actions that may significantly affect the quality of the human environment. Real property includes items like buildings, structures, land, etc., while personal property includes items such as flight hardware, parts and materials.

"... Constellation and other NASA programs will continue to focus on ways to rescue existing components and facilities ..."

NASA has said that since Constellation and other NASA programs will continue to focus on ways to reuse existing components and facilities, many shuttle assets will be re-utilized, and the potential environmental impacts associated with disposition of remaining shuttle property are expected to be minimal to moderate.

Inside a Constellation Cockpit

Work continues on the Advanced Cockpit Evaluation System software that began in 2004. Four years ago, NASA pilots and engineers started working with two private companies, Rapid Imaging Software and Aerospace Applications North America, to develop software that combines a pilot's cockpit view with preloaded imagery to provide a complete visual of the pilot's external surroundings. NASA engineers continue to test and fine-tune the software, which may be used in the future for the Constellation Program.

In February, NASA reported that the software was demonstrated for Constellation using a research aircraft at Ellington Field near Johnson Space Center in Houston. Aboard the aircraft were several research and astronaut pilots. The software engineers configured the system to display a lunar black sky with landing corridors, keep-out zones, targets and other flight data on one of the monitors.

The other two monitors showed a blend of video from outside the test aircraft and synthetic imagery. Constellation is hoping to use the system on board the Altair lunar lander and lunar rover, as well as in helmets for spacewalks and in rendezvous operations with Orion.

The Advance Cockpit Evaluation System software takes live video from outside the spacecraft and blends it with other imagery sources such as satellite photos, heads-up displays and topographical maps. Then the software projects a composite image on flat-panel displays in front of the pilot. The combined imagery displays would allow the pilot to see landing areas, flight paths, keep-out areas and terrain information even if the view from the cockpit offers little or no visibility.

Orion's Safety Blanket

A prototype of the Orion heat shield or the Thermal Protection System manufacturing demonstration unit developed by Boeing Advanced Systems. A new prototype heat shield designed to protect the Orion spacecraft upon re-entry combines shuttle re-entry technology and Apollo Program ablator designs. The prototype is also known as a manufacturing demonstration unit and is the size and dimension of the one that will actually be used on Orion. At five meters in diameter, the heat shield is the largest of its kind ever built. The Crew Exploration Vehicle thermal protection system at NASA's Ames Research Center shipped the shield to Kennedy Space Center in November, and those working on Constellation were able to see in person one of the first pieces of Orion's full-scale test hardware. The hardware was built partially because of the need to develop heat shield evaluation, inspection and handling procedures – and just to prove it could be done.

"At five meters in diameter, the heat shield is the largest of its kind ever built."

Some parts of Orion's thermal protection system, which serves as a barrier against the extreme heat upon re-entry into Earth's atmosphere, will use shuttle tile materials. But, the base of the heat shield endures the highest temperatures and will burn away or "ablate" as it descends through the atmosphere at more than 25,000 mph. Orion will have an ablative heat shield that burns off slowly, because it is expected to encounter temperatures as high as 5,000 degrees Fahrenheit during re-entry into Earth's atmosphere after a lunar mission, compared to about 2,300 degrees for a space shuttle re-entry.

The prototype heat shield is made of the leading candidate material called PICA – short for phenolic impregnated carbon ablator. PICA material was chosen based on a successful previous use on a small robotic spacecraft that returned to Earth in January 2006. Because the Orion is 16.5 feet in diameter, its heat shield could require up to 200 pieces of PICA blocks.

Currently, the prototype heat shield resides in Hangar N at Cape Canaveral Air Force Station, where it will undergo several months of nondestructive evaluation testing that include laser scans and X-rays. But, before that can happen, the team at KSC must learn the best way to maneuver the prototype. Because of its size, new handling standards will be developed and tested and later applied to the actual flight heat shields.

Human Capital: Strategies for the Future

NASA's Report to Congress

The headlines weren't good.

"Shuttle Retirement May Bring Loss of 8,600 Jobs, NASA Says," The New York Times proclaimed. "Massive Job Cuts in Space Program Likely," the Associated Press chimed in.

But when NASA's early estimates on the expected impact of transition on the workforce were released on April 1, Bill Gerstenmaier, associate administrator for the Space Operations Mission Directorate, maintained that the situation wasn't as dire as the stories suggested.

"This is a snapshot in time," he told reporters. "It's clearly a work in progress. We need to be careful that we don't overreact to these numbers, that we don't send an unintended message to our workforce that there are going to be these huge drops up and down, because we honestly don't know."

Going by the numbers laid out in the Workforce Transition Strategy, it wouldn't be hard to become concerned. The estimates call for NASA's contractor workforce for the Space Shuttle Program and Constellation to drop from 20,900 this year to 15,100 in 2013 – and that's after dipping down to about 12,500 in 2011. And at some individual centers, the picture is even more worrisome: Kennedy Space Center is predicted to go from 8,000 contractors to as low as 1,600. Michoud Assembly Facility drops from 1,900 to somewhere between 600 and 1,100 after shuttle retirement.

"But the numbers don't ... tell the whole story."

But the numbers don't – and at this point, can't – tell the whole story, Gerstenmaier said. They don't represent any plan or goal of the agency; they don't even represent a complete picture. In fact, they can't really even be called estimates; rather, they represent an absolute minimum baseline from which to build upon.

In December, NASA was given 90 days by the Consolidated Appropriations Act of 2008 to report back to Congress a strategy for minimizing job losses caused by the transition from the shuttle to Constellation. The report was to include specifics on how NASA would make the most of its existing workforce, efforts to distribute the workload equally between centers, new tasks for the centers most affected and estimates on workforce numbers.

The problem was that some of those estimates couldn't be made.

"There is a lot of work that is not folded into these numbers, that is yet to be determined," said Richard J. Gilbrech, associate administrator of exploration systems. "We just announced our lunar (center) assignments in October. So we really need to work with the centers who have the lead roles in those areas and decide what kind of acquisition strategy they have, what support centers would be supporting those lead roles."

"When NASA awards a contract, the contract doesn't specify how many employees will be needed."

And that's only part of the puzzle. Once the center assignments are made, NASA is still limited in how well it can estimate the number of people it will take to do the work. When NASA awards a contract, the contract doesn't specify how many employees will be needed – NASA pays for the work to be done, and the company decides how many people it will take to do it.

Because the contracts are awarded competitively, NASA can't predict numbers of workers or locations of work until a contract is awarded. NASA has awarded contracts for the Ares I Upper Stage and the Ares I instrument unit and is working out details such as workforce levels with the companies involved. But the contractors for the Ares V Core Stage, Earth Departure Stage and the Altair lunar lander have yet to be selected, so that work wasn't taken into account in Workforce Transition Strategy numbers. The same holds true for the Commercial Orbital Transportation Services Project or construction of new facilities needed to support Constellation.

That's all key data that will have a significant impact on workforce numbers. Just how significant is hard to predict, but Gerstenmaier pointed out one positive indicator: NASA's budget.

The budget is expected to remain steady over the next several years, and since the bulk of the budget pays for labor, the numbers imply that the amount of labor NASA buys will stay the same. The same number of dollars currently paying for 25,600 shuttle and Constellation employees will still be available to spend exclusively on Constellation after the shuttle fleet is retired.

“The budget is expected to remain steady over the next several years ...”

"That says, in an overall magnitude, our workforce will probably be about the same," Gerstenmaier said. "Maybe slightly smaller than we are today, just because of inflation or changes in cost or skill levels of workforce. But it gives you a feel that, at the macro level, there is not a huge upswing or downswing in workforce."

Those activities are further out, and don't help the temporary dip in workforce numbers expected after the shuttle retires in 2010, but Gerstenmaier said he doesn't expect those to be as low as the report indicated, either. The numbers were generated without taking into account the fact that Michoud is currently not fully staffed to its available ceiling, the likelihood of flying space shuttle Atlantis for two additional missions previously planned for other orbiters, or the workers that will be needed to actually retire the shuttle fleet once it has stopped flying.

"Those are some of the reasons why we need to be careful when we look at the chart, that we don't overreact to some of the numbers that we see," Gerstenmaier said. "We may not see nearly that kind of reduction at Kennedy in '09. ... We would actually like to hire some more folks (at Michoud) to help us with our tanks."

> "The agency will be doing more development and less operational activities."

One thing that is pretty certain, however, is that the nature of some of NASA's work will have to change. The agency will be doing more development and less operational activities. But that doesn't mean all the operations people will have to go. Centers are developing retraining opportunities, and more and more shuttle employees are making time in their schedule for Constellation or other non-shuttle work. In December, for example, less than half of shuttle program employees were working exclusively for the shuttle program.

Not to mention that there will still be a need for operational skills in the future.

"We expect to have these rolling waves of development where we design, do the evaluation, prove and validate the system, and then hand it off to the operators down at Kennedy," Gilbrech said. "Then we put that team on the next wave of development."

> "We expect to have these rolling waves of development"

NASA will be updating the Workforce Transition Strategy report every six months. But since the agency isn't expecting to award any major Constellation contracts in the next few months, Gerstenmaier said the only numbers likely to change much in the next update are those for 2009. Changes for 2010 and beyond should start showing up in a year or a year and a half.

In the meantime, however, Joel Kearns, transition manager for the Space Operations Mission Directorate said the report gives the agency a starting point in planning for the future.

"The estimates are incomplete, and they give us a worst-case idea of what things may look like in 2011," he said. "That allows us to be pro-active now, three years ahead of time, and get our centers and industry in position to support Constellation and get Orion and Ares flying as soon as possible."

Moving Forward

CxP Challenges– Orion Takes Shape

Launching Our Future

At five meters in diameter, Orion's heat shield is the largest of its kind ever built.

The last time NASA designed and built a human rated space launch vehicle was in the 1970s. The space shuttle took more than a dozen years to design, test and finally launch in 1981. Today's International Space Station started as Space Station Freedom in the mid-1980s and began on-orbit assembly in the late 1990s.

"We don't build human-rated spacecraft very often," observed Mark Geyer, Orion Project Manager, "so you could say that is the Orion Team's biggest challenge."

"We are in the midst of the preliminary design phase, validating requirements and refining the vehicle's design down to the specific performance of each component," Geyer explained. "Our next big milestone is the Preliminary Design Review in September — a critical project milestone. But there are still challenges to overcome before the design review. There are a number of systems architecture decisions to address and trade-offs to consider. Ensuring the right decisions are made now — decisions that won't compromise the vehicle's flexibility or integrity, safety or budgetary requirements — is absolutely essential.

But what are the project's immediate challenges given the current state of the Orion's design?

The Serious Issue of Weight Control

One that comes to mind has to do with the requirement that the Orion land in water. The initial decision to land in water was made because land landings require airbags on the vehicle, adding more than 1,000 pounds of mass. On a crew module of the Orion's size, 1,000 pounds does not sound like much. However, consider that everything on the crew module is impacted on acceleration to the moon and deceleration to land on Earth. Every pound on the module is multiplied by about nine pounds of fuel required to launch into orbit.

Protecting the Crew in Contingencies

Every pound is a precious commodity on this vehicle," Geyer explained. "We didn't think we could support 1,000 pounds for a landing mechanism, but we could land safely in the water and eliminate the need for additional mass. However, there may be contingencies where Orion might have a land landing. We have to demonstrate that Orion could land on land with the parachute system in place today and not injure the crew – a tough thing to do."

Pictured above: Orion Project Manager Mark Geyer, center, is briefed on hardware at Langley.

The primary structures of Orion are not designed to receive that kind of impact. The team is looking at ways to make the structure more accommodating so it would perform similar to the way a car's structure would in a collision. The seats are being designed to handle extreme g forces. NASA has consulted with NASCAR on the design of seat restraint systems used to help race car drivers withstand multiple g forces, up to 100 g in the worst-case situations. Although it's a contingency scenario, designing for unforeseen events is still a driving analysis for the Orion development. Engineers need to know how the vehicle will perform on landing to cover contingencies and ensure crew safety.

> "... the design of seat restraint systems used to help race car drivers withstand multiple g-forces ..."

Big Decisions on Critical Systems

Another challenge is that while the preliminary design phase is underway and basic decisions about critical survival systems are being made, flight tests are beginning. Right now, all of these tests are driven by the Launch Abort System or LAS, which is one of the reasons Orion will be a safer vehicle – because the crew will be able to get off the launch vehicle in almost any contingency.

But Orion is a much larger capsule than Apollo – 5 meters in diameter instead of 3.9 meters – and requires approximately 500,000 pounds of thrust to get it off and away from its main propulsion elements. To make sure it works, the LAS needs to be tested before the team finalizes the drawings in the critical design phase. The Pad Abort-1 (PA-1) flight test will take place December 2008 at White Sands Missile Range in New Mexico.

Pictured above: Static test firing of the Orion Launch Abort System jettison motor at Aerojet in Sacramento, California.

"You have to draw a line and say, OK; we know we're in our flight vehicle's preliminary design, but for the flight test we're going to assume that the capsule looks like this, the launch escape system looks like this, and the avionics and software look like this." Geyer explained. "We have to make educated assumptions."

The PA-1 Crew Module test structure was built at Langley Research Center and was shipped to Dryden Flight Research Center, where it will be outfitted with avionics. The software that activates the PA-1 flight test is already being tested at the Lockheed Martin Exploration Development Lab, just offsite at Johnson Space Center. Five centers are involved in this effort, making it truly an agency effort.

"The other cool thing about the Launch Abort System is that it has three motors," Geyer said. "The largest of the three motors generates 500,000 pounds of thrust to assure safe separation of the capsule from the launch vehicle in the event of a problem."

A second motor provides for separation of the cover from the crew module in nominal and abort modes. The third motor, located in the tip, performs active attitude control for the separated vehicle during an abort. All three motors are in the midst of development tests, which must be completed prior to flight tests.

Handling the Heat

Another important challenge has to do with the Thermal Protection System or TPS or heat shield (see "Orion's Safety Blanket" in the T&R Activities Progress Report feature also in this issue). The TPS team is looking at two different configurations for the heat shield. One is a ceramic-like material called PICA – short for Phenolic Impregnated Carbon Ablator – and the other is the Avcoat material that was used in the Apollo heat shield design. The differences between a shuttle re-entry, in which the heat shield materials must withstand lower temperatures for a longer duration and be reusable, and a capsule re-entry, in which the heat shield would ablate or burn off, mean that the shuttle's heat-resistant tile technology would not provide thermal protection for the Orion. Testing of both TPS materials is underway at Ames Research Center and Johnson Space Center arc jet facilities.

Working With Shuttle

The Orion may look as if it's an updated and super-sized version of the Apollo command module, but it's actually much more. Many of its advanced subsystems are based on legacy systems and operational methodology developed and proven for the space shuttle and International Space Station programs. In fact, the shuttle is uniquely qualified to serve as a test platform for Orion subsystems.

"We want to make sure that the Orion's rendezvous and navigation sensor will work in space, so we're planning to do a detailed test objective or DTO with shuttle," Geyer explained. "We're in the process of selecting the NASA center team that will actually integrate the work."

The shuttle program may be coming to an end, but it will continue to be a stepping stone for Constellation, influencing the future of space exploration.

A Life in the Program.

Michael Allen

Marshall's Own Space Shuttle Transition Manager

When Mike Allen talks about his life and work, it is with the easy manner of someone who is comfortable in his surroundings and a little of that Alabama drawl. Though Allen is the Space Shuttle Transition Manager for Marshall Space Flight Center, he sounds mildly surprised as he counts back and realizes he has been a part of the NASA landscape for more than 20 years. Originally from Childersburg, a little town south of Birmingham, Allen has worked most of his professional life in Huntsville, Alabama, just a stone's throw from where he grew up. He graduated high school in 1975, attended junior college for a couple of years and then transferred to Auburn University. When he graduated from Auburn in 1981, he went to work for a construction company. It wasn't until October of 1986 that Allen found himself at NASA.

"It was kind of interesting, I was looking for another job and a friend of mine – an old college roommate – called me up and said that there was an opening here at Marshall," Allen said. "He was working up here and really enjoyed it, so I interviewed and they hired me."

Allen seems matter-of-fact about his hiring, until he talks about when he first saw the shuttle.

A Humbling Realization

"Well, when I first came to Marshall, I started out as an independent assessment analyst in the comptroller's office," Allen said. "I worked there for about seven months and then moved over to the shuttle. It was really eye opening when I got here and I thought, 'Gosh, I'm working for these guys and these are brilliant people and here I am in the middle of this and we are going back into space (after Challenger) and we are going to fly this thing again.' The space shuttle was something you saw on television and if you had never been in the middle of it you didn't know what it took (to support it). It was really kind of humbling."

He never pictured himself doing something like that, or having the ability or opportunity to do it.

"I never pictured myself doing something like this ..."

"All of sudden, I was right there in the middle of watching stuff get built," Allen said. "It was interesting because I had already done construction for five years and been involved in putting up buildings and things of that nature. But you know, when you saw the work that went into it, when you saw things being built for the shuttle for Return to Flight ... After all of the things that had happened, it was really amazing. The techniques that you used and the amount of effort that you put into it – well, it was just astonishing."

Pictured above: The X-34 demonstrator on the ground at Dryden; NASA shut down the X-34 project in early 2001.

From Project to Program

Allen worked on the solid rocket boosters for about two years, and then transferred to the space shuttle main engine. He worked on the main engine for six years before a one-year stint at headquarters in Washington, D.C. At headquarters, Allen was the shuttle liaison to the Deputy Associate Administrator for the Space Shuttle Program. He returned to Marshall and went into the X-34 program, working as a deputy for two years and eventually moved into the project manager's slot. Allen worked as the project manager until 2000, when he went into the engineering directorate to run the propulsion test lab until the transition effort began in 2006.

"You know, I really feel like I've been lucky in that I've been in the project side of the house and really understood how the project was run from a shuttle standpoint," Allen said. "And then I was also managing one of the X programs and it was a completely different idea of how to go about doing things. In the X program, you did everything during the era of 'faster, better, cheaper,' while in the shuttle program you had to make sure that everything was perfect and maintain that rigor. Having those two kinds of extremes and then going down and working in engineering directorate to run a test lab, which is a service organization ... I've done a little of both sides."

Allen said he especially enjoyed his years in the propulsion test lab because of the hands-on aspect of the work.

"We did all the development work for upgrades, or anything like that, on the main engine," Allen said. "We didn't do the big engine testing – that was done at Stennis, but we've got the capability here with our big testing labs. You really saw how each one of the parts of the main engines and solid motors and everything else that they needed – how they really worked, because you were testing components more than you were testing the engines as a whole. You had to build it up and then you actually got to flip the switch and see smoke and fire come out of the right end of it. It was always fun."

Pictured above: Testing an SSME at Stennis Space Center.

> "... you actually got to flip the switch and see smoke and fire come out ..."

In Transition

Over 20 years at Marshall has given Allen the right set of tools for his current position. He knows the people and the facility, and is able to apply his experience in different programs and labs to the current transition effort.

As the Space Shuttle Transition Manager for Marshall, Allen actually fulfills two roles – center lead and space shuttle lead. On the shuttle side, Allen's main focus is to oversee the coordination of the projects – every aspect from the people to the property – and then to interface back to program's shuttle transition office.

"All of the coordination has to do with pulling budgets together and making sure that everybody's talking off the same sheet of music," he explained.

No Instruction Manual for Transition

As the center lead, Allen is responsible for understanding what Marshall's center requirements are and making sure nobody's doing anything that will have an adverse effect.

"When I first came over here, to the Transition office in 2006, I was actually the external tank transition manager, and Sandra Coleman had the responsibility of overall shuttle transition," Allen said. "She retired, and they asked me to take over. And, yeah, it was kind of just hit the ground running and catch up."

He wasn't on his own, however. Each project at Marshall has a dedicated transition lead, and they were already in place. And with Allen's shuttle experience, he knew what they were talking about when someone mentioned shutting down this or getting rid of that.

Even so, he has yet to stop running.

"It has been a whirlwind for two years, and it's only increasing," he said. "There is more and more activity – just as fast as we can go."

Allen is not daunted by the fact that there is no instruction manual for transition.

"And as we transition this big monster called 'shuttle' down, we are finding out ... there's really no road map on how to do this."

"What we are finding is that each organization has always done things differently," Allen said. "And, as we transition this big monster called 'shuttle' down, we are finding out, OK, there's really no road map on how to do this."

Allen says within the larger umbrella of the shuttle program organizations like procurement – the property people – know what they're doing because they are constantly moving equipment around within the program. But preparing to retire an entire program's worth of equipment is a whole other matter.

"We went through a long learning process of figuring out what can you do with property when you get rid of it," Allen reflected. "And, we've really come a long way and now our guys know as much as anybody else."

Four Contractors, Four Processes, All Complicated

Marshall also has four contractor groups – with four different processes for shutting down programs – to consider as the transition takes place.

"There were a lot of things where we thought, well you just kind of handed it over to somebody and said 'we're through' and they did their magic and it went away. What we found as we went through this process was the center of operation guys had a very good process in place and then we found out also that every contractor has their own process as well," Allen said jokingly.

And this methodology applies to literally everything, from the smallest pieces – nuts and bolts – to the biggest.

"For each piece of property, somebody has to verify that it is there, and then we go through a process of seeing who needs it – does anybody else in the government need it, does anybody at NASA need it?" Allen asked. "If not, you go on to the next process and then you hand it over to the property people within the organizations, either to a contractor shop, or a center – something of that nature. And, they have a process of disposing of it."

Disposing of it could mean a number of things. It could be sold for someone else's use, or as scrap metal. And there are plenty of museums out there, eager to get their hands on shuttle memorabilia. Allen says there is a tremendous desire out there for all of this hardware.

> "One of the things we are trying to figure out is who gets what ..."

"One of the things we are trying to figure out is who gets what, because I think we're going to have more people asking for pieces of property than we can give away."

Whether the property finds a home in a museum or in a warehouse, it's not as simple as just handing it over and walking away.

"There is a long process and it has taken us a while to get our hands around it," Allen said. "We really didn't understand the complexity of everything we went through initially. We've built all of this stuff, and we've thought about how we fly it and how we operate it. But we really had never figured out how to stop doing it. And, I think everybody within the transition organization, not only here but all over, it has really come as recognizing this as a bigger job than we ever thought it would be."

Multiple Programs, Multiple Hats

But the shuttle is just one part of transition at Marshall and across NASA. Allen says that many people at his center are already working on the other part: Constellation.

"We are really lucky in that aspect because we have similar Ares projects as to what we have in the shuttle," Allen said. "The solid rocket motor and boosters, for instance, will essentially just transition over in whole to Ares 1 First Stage. So, the project guys and the engineering guys today are working kind of hand in hand. And the same thing happens for the engine and the external tank."

Pictured from left to right: Cody McPeters, Mike Allen, Steven Brooks, Kathy McMillan and Len Bell.

Because of that, Allen said, transition is not as much of a worry at Marshall as it might be.

"There are issues to work and hardware to go build and procure," he said. "Everybody has been so busy that I don't think that they've had a chance to really think about the shuttle going away."

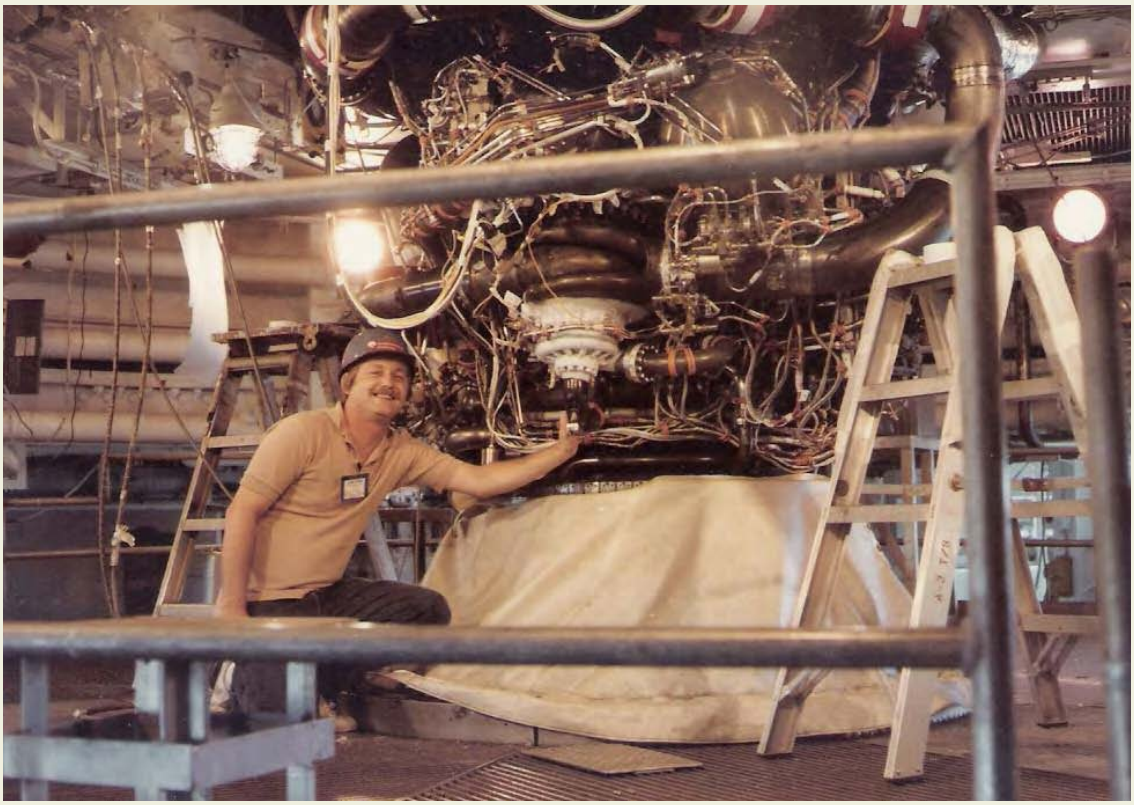
Not Quite Business As Usual

The same could be said of the Michoud Assembly Facility, which Marshall manages. It is becoming a multi-use facility, going from shuttle external tank exclusively to welcoming two new elements of Constellation. Marshall also oversees the Santa Susana Field Laboratories in California, which are being shut down this year. The remediation, demolition and restoration of that facility will be a large undertaking as well. So for Marshall, it is not quite business as usual.

“... we have this workforce that is just focused in on what they love to do.”

"I think for most of the folks here they are just, they are so focused on shuttle and flying shuttles right now that they are really not thinking about anything else," Allen said. "And you know it is great for us – for Marshall and the shuttle program – because we have this workforce that is just focused in on what they love to do. They are going along and saying, 'You know, I love to do this, and I'll do it till the very end, and then we'll do something else.'"

Propelled to Excel



Frank Duleba: A Contractor's Tale

Frank Duleba's story starts in Homestead, Pa. First born and only boy -- in a family of seven, he soon set the standard for troublemaking among Francis and Elsie Duleba's brood. By age six he was already curious about how things were put together and had become quite adept at taking them apart.

One oft-recalled family story places young Frankie at a family gathering at his Grandma's house. Perhaps he was bored with his four younger sisters or just itching to get into mischief. Whatever his motivation, he meticulously removed all the screws that secured one of the front headlights on his Uncle Buddy's car. Frank remembers that his Uncle Buddy had a habit of tapping the hood of his car as he walked around the front of it. Only this time when he tapped it, out fell the headlight.

Duleba takes this incident as proof that he was destined for some kind of mechanical career.

A Transcontinental Move

In the summer of 1962, after years of working as a rigger for United States Steel Corporation, Francis Duleba moved his family cross country to Thousand Oaks, Calif., where he began work in the Rocketdyne division of North American Aviation. The company is now known as Pratt & Whitney Rocketdyne.

Duleba remembers that the Thousand Oaks of 1962 was a far cry from the Los Angeles-area edge city it is today. Thousand Oaks was out in the middle of nowhere, and the only significant thing in close proximity to the new housing tract the Dulebas called home was Rocketdyne and a number of other aerospace-associated companies.

"We grew up with rockets," Duleba recalled. "And even if your dad wasn't in rockets, most likely he had something to do with the aerospace field."

The Vester family lived next door to the young family and Duleba found a second home with their four boys. Back then, the kids made their own fun. During the windy winter months, they would catch tumbleweeds, tie a rope to them and use them as makeshift skateboard sails.

"We were always tinkering with something: soap box derby cars, model airplanes, pellet-fueled rockets," Duleba said. "I remember building model planes out of kits with them. We'd have all those structure drawings laid out on tables, cutting balsa wood with razor blades for precision. Then we'd go fly those homemade aircraft across the street on the Glenwood school basketball courts."

From Shop Class to Machine Shop

Precision was something in Duleba's blood. He remembers taking a 0-1 micrometer to his fourth-grade summer school class one day. His class project was to measure his classmates' hair thickness. A little later in his academic career, Duleba's father introduced him to a 1960s Rocketdyne manual on precision measuring instruments. But the real practical experience came a little later, also at the hands of his father.

By the time Duleba was in high school, he was practically a shop class rat, taking an array of electives including Metal and Electronics, when he wasn't messing around with music and his guitar. He credits two of his teachers in particular, Mr. Olander and Mr. Loewe, for skills in metal working, electronics and drafting that he continues to use on a daily basis. By the time Duleba graduated in 1973, he was eager to put his skills to work. So, instead of taking off the summer to enjoy Southern California of 1973, he started as a drill press operator at The Talley Corporation in Newbury Park, not far from Thousand Oaks.

Pictured above: The Lockheed L1011 jumbo jet and the F-14 “Tomcat” fighter.

"My dad was instrumental in getting me that summer job," Duleba said. "It was a terrific learning experience in a number of ways."

The company manufactured actuators for aircraft components – F14 and F15 flap actuators, Lockheed L1011 jumbo jet passenger door actuators and emergency exit beveled spring actuators. And Duleba was a quick study; during the summer he progressed from drill presses to turret lathes to automatic cam-controlled lathes.

Getting a Taste of Testing

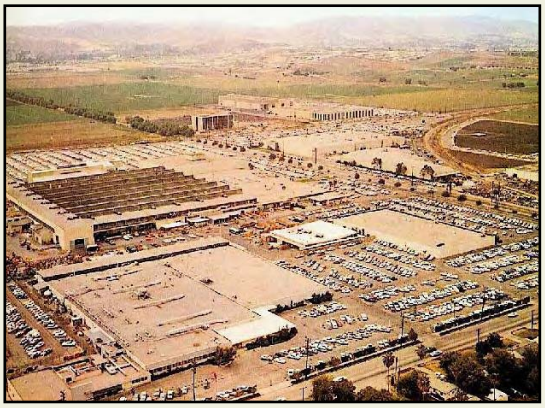
From there he went into electronic manufacturing as a motor and actuator test inspector and was introduced to statistical acceptance processes. He would test 20 actuators, and if two failed, they'd be fixed and a new lot of 20 would be tested. In the course of the job, he found that learning safety vigilance early on was valuable during a time when safety regulations were scarce.

"In the motor and actuator testing area, an L1011 emergency door opener actuator exploded, sending fragments everywhere in the test and assembly area," Duleba recalled. "Everyone was wearing safety glasses, so fortunately no one was hurt. But after that, barriers were installed in the test areas. I think I was lucky to learn a solid appreciation for safety precautions at an early age. Even when I was working on hobbies with my dad, we wore safety glasses."

Duleba's mechanical ability also took him through a brief stint in Kmart's automotive repair department, where he learned about customer relations.

"I was taught that the customer is always right," Duleba said. "But if the customer is not educated, or advised of the critical information he needs to know ... then sometimes the customer isn't always right."

He took this lesson to heart and applied it to his career going forward, always making sure to provide his customer, in later days on the space shuttle main engine program, with the information or data NASA or the Defense Contract Management Agency needed to make the right decision.



Pictured above: The Canoga park Rocketdyne facility cicra 1960.

Launching a Career

The first real red-letter date for Duleba was July 5, 1977, the day he started at Rocketdyne as an assembler in precision rocket components. He began his tenure in the 100,000 parts per million clean room at Canoga Park, thanks to his dad, who helped him get the interview that landed him the job.

"I worked a variety of jobs at 'the Rock' in turbo-machinery assembly in the valve department and eventually worked up to final assembly," Duleba said. "I went from union labor Grade 6 to Grade 10 all the way up to Grade 13 from 1977 to 1981– the year of STS-1. I used to keep a calendar log book and, looking back at it years later, I realized that 27 of the valves I worked on flew on the three engines for the first missions of the shuttle program."

In 1981, ever safety-minded and indulging his passion for precision, Duleba applied for a salaried position in quality planning at Rocketdyne and got it. From this point on, his focus was all about inspection on all things main engine and in all phases of manufacturing, assembly, test and labor.

Man-On-The-Go

During this time, the National Space Technology Laboratory – or the NSTL, now known as Stennis Space Center – needed help with their main engine test firing responsibilities. Duleba was the guy for the job and, between 1981 and 1987, made many trips down to the Mississippi Gulf Coast to support the test stands and Building 3202 flight engine processing. Three things stand out in Duleba's memory about that period in his life.

Pictured above: The A-1 Test Stand at Stennis Space Center.

"The first time I witnessed a test firing ... it was totally amazing," Duleba said. "I was at the Test Stand A test control center and my whole body shook. Then there was my dad, who had worked on the Apollo program at Rocketdyne and was also coming down to the NSTL to support main engine processing at the same time I was. So, there were many times when we'd cross paths or even work side by side."

And then there was the time Duleba got to accompany main engine 2028 to Kennedy Space Center.

"That was the only time I was ever at Cape Canaveral," he said, "but I got to go into the Orbiter Processing Facility at Kennedy and actually sit in Discovery's cockpit before its maiden flight."

Amazingly enough, after 31 years working on the shuttle component that powers the orbiters through earth's gravitational field into low Earth orbit, Duleba has never seen an actual launch.

Man-On-The-Spot

The next high point in Duleba's space program career was in May of 1987, when Rocketdyne asked him to move full time to Mississippi to support the shuttle main engine program at Stennis.

"I've said over and over again, it was the proudest moment of my life," Duleba said. "I knew the job and I knew all the guys at NSTL, as well as the guys who traveled from Kennedy who I worked with at Stennis, but I hadn't even put in a formal transfer request. It was kind of a culture shock at first, coming from southern California to Mississippi. But I knew my colleagues at Stennis, and everyone was so warm and welcoming. We had a lot in common."

And they've been there ever since. First they lived in Picayune, Miss. But later moved to a 16-acre spread in McNeill where they built a house and a three-acre lake, which they stocked with Florida bass. That's where Frank and Carolyn, his wife of 28 years, their two daughters and their grandchildren safely rode out Hurricane Katrina.

From Turbo Pumps to Transition

Duleba says he knew he'd have a career with Rocketdyne once he signed on, and after 31 years working in the space program his intuition has proven true.

"My father's colleagues at Canoga Park told me that I'd be able to retire off the space shuttle main engine program," Duleba remembered. "There was just so much opportunity in front of me."

Today, he is busy working the transition and exit plan for the shuttle engines, making sure that everything is accounted for so that the right decisions can be made about what to do with which asset and when. Should it be transferred, excessed or destroyed?

"I'm deep into the documentation, gathering the information and data and funneling it through Tim Lorenz, our Pratt & Whitney Rocketdyne Stennis site focal, to Canoga Park or to Cindy Canady, the site Transition and Retirement Project Manager here at Stennis," Duleba said. "I'm enjoying it because it's different and it's interesting. I get to go everywhere on the site, into all the facilities."

Retirement is not an Option

Looking back on his long career and reminiscing about his personal milestones, the Silver Snoopy award he received from NASA Astronaut Pam Melroy on November 9, 2004 ranks right up there with his marriage, the birth of his daughters, his first day at Rocketdyne back in 1977, and his transfer to Stennis in 1987. Recognized for dedication and efforts that enhance the safety and success of human space flight missions, Duleba received his Silver Snoopy alongside his friends and Pratt & Whitney Rocketdyne co-workers Prentice "Whitey" Carte and Donnie Walters. He's proud of what he achieved and the role he played on the main engine program and he's sad to see the shuttle program end.

Pictured above: Astronaut Pam Melroy and Frank Duleba with his Silver Snoopy Award.

"The space shuttle main engines have been an incredible success story," Duleba said. "They've been so reliable. They've had 100 percent success."

But Duleba is not planning to retire with them. He says he'd like to continue to work for Pratt & Whitney Rocketdyne. There is still a lot he can do and plenty of places he can contribute the wisdom of his experience with mentoring and teaching.

"I grew up in the old school, where we were all team oriented," Duleba said. "When the start button, that big red button, was pushed for a test firing, everybody was equally proud because everybody played a part in its success. It's team work at its best."

The main engine program is better for Duleba's diligence and attention to detail and precision. And, in fact, Rocketdyne was pretty lucky to snag him back in 1977 and keep his attention for all these years. Who knows what would have happened in Frank Duleba's life had he pursued his other talent? In 1974, after playing guitar on several episodes (#6 and #9, actually) and rubbing shoulders with the likes of Ronnie Howard, Anson Williams and "the Fonz" on the set of Happy Days at Paramount Studios, Duleba decided he had better get back to work.

How fortunate that Hollywood's loss was the space shuttle main engine program's gain.

Weighing In

Quips & Quotes

Marshall and Stennis and Rendezvous Subscribers Speak Up

What was particularly interesting about the focus and brainstorm sessions (FABS) we conducted for this issue at Marshall Space Flight Center and Stennis Space Center was that we had almost equal representation of NASA civil servants and NASA contractors. We were curious about the differences between the various groups within the greater human space flight family in regards to how they view, and are handling, shuttle transition and retirement. We also asked our subscribers to share their thoughts regarding how they're handling the fly-out of the shuttle program, its accelerated launch flow and the aggressive build-out schedule for the space station, while the agency is also focused on the future of space exploration with the Constellation Program. Click on a question below to see the responses from Marshall, Stennis and our subscribers.

- What are your thoughts on the current state of the Shuttle Transition and Retirement Program?
- What words of wisdom would you share with someone new to the program (shuttle or Constellation)?
- What do you think are your greatest challenges and the challenges facing the shuttle program as a whole, during the remaining flight schedule?
- How are you handling the accelerated launch flow?
- Are you multi-tasking more than before?
- Are you aware of, or are you participating in, any efforts to capture shuttle knowledge for posterity?
- How would you describe the difference in workforce focus between now and the period prior to the announcement of Constellation?
- What impact is Constellation currently having on your day-to-day work responsibilities?
- What's your biggest concern right now?

What are your thoughts on the current state of the Shuttle Transition and Retirement Program?

"The road map is vague but everyone has the same desire to work the new program. Personally, I'm not afraid that I'm going to lose my job. I'm more anxious about what my job will be. Will I have a choice as to what I wind up working on? Do I jump ship now and re-badge, or do I wait and see?"

-MSFC

"I think we need a lot more communication about people retention as far as our skill base is concerned. Between Apollo and shuttle, we lost a number of engineers who just left the program. Do they want to retain our greybeards to protect the skill set or go after new hires with new ideas and ignore our lessons learned?"

-SSC

"If SSME is going to be dead post-shuttle, then where will they put me? I have no experience with the new engine, so will I get stuck in a corner because I'm loyal to SSME?"

-MSFC

"I think our transition managers work in a vacuum, and they don't take the time to communicate what's going on down the hall. Or maybe they just don't know. Also, it seems that they're focused on transitioning hardware and facilities and not really focused on transitioning people to the new program."

-MSFC

"It doesn't seem as if our management is sharing any of the information they have, or maybe they just don't know. Our management should be meeting with Constellation management and flowing the information down to us."

-MSFC

Rendezvous responds: *Program Manager John Shannon said in a recent message to shuttle employees that the shuttle and Constellation programs are looking for ways that shuttle employees can start contributing to Constellation systems. Already, more than half of shuttle employees are lending their skills and time to other programs, including Constellation. You can read about one example of expertise sharing between shuttle and Constellation in CxP Challenges — Orion Takes Shape in this issue.*

What words of wisdom would you share with someone new to the program (shuttle or Constellation)?

"Keep safety in mind at all times."

-SSC

"You can make your career in the space program whatever you want it to be."

-SSC

"Take pride in what you do. No matter what you do, if you take pride in your performance then you'll make a difference."

-SSC

"It takes a village to raise a rocket."

-SSC

What do you think are your greatest challenges and the challenges facing the shuttle program as a whole, during the remaining flight schedule?

"Keeping the hardware flowing while not impacting the schedule."

-MSFC

"I'm concerned that the critical, skilled employees necessary for safe shuttle fly-out will leave to pursue other opportunities as we get closer to the end. Also, I'm concerned about keeping suppliers focused on process control and on-time delivery of quality products necessary for safe shuttle fly-out."

-MAF

"Retaining certain key personnel to the very end will be a challenge. Certain aspects of the shuttle will not be required for the new vehicle. The people involved in those areas have a lot of uncertainty and have been looking at their options."

-WSTF

How are you handling the accelerated launch flow?

"We are working long, hard hours. It's tough. Holidays and weekends are being sacrificed for the missions."

-MSFC

"We're trying to evaluate changes and improvements objectively. We're asking what's necessary."

-MAF

"We're cross-utilizing resources when necessary to accommodate peak work loads."

-MSFC

"As long as the vehicle continues to cooperate, the accelerated work flow is a nice pace."

-JSC

Are you multi-tasking more than before?

"More than ever."

-MSFC

"No, just concentrating on what needs to be done."

-MAF

"In some ways, yes. As a contractor, there are Constellation opportunities we want to be able to take advantage of while still maintaining our shuttle workforce. This necessitates juggling resources."

-MSFC

"No. The vehicle performance is outstanding and our organization is driven by this."

-JSC

"Yes. We still have shuttle and station work, but the new vehicle is consuming more and more of our attention. Initially, it was just cost estimates, but now it's a lot of planning with development testing."

-WSTF

Are you aware of, or are you participating in, any efforts to capture shuttle knowledge for posterity?

"We were just talking about 25 filing cabinets full of notes from engineers who have already transitioned out of the program or who retired. What do we do with them? Do we need any of that stuff for the last two years of our program? Probably not. But maybe some of that information and expertise could prevent the new program from reinventing the wheel."

-MSFC

"I have no insight as to what we need to retain in order to close out the shuttle program, or what we need to do! Do we keep all the imagery and test data, secure it in a safe place for historical reasons? Or do we just flip out the lights when the last shuttle mission lands?"

-MSFC

"They found parts in the warehouse that were dated February 16, 1963. It's still stocked with stuff left over from Mercury and Gemini!"

-SSC

Rendezvous responds: *A Shuttle Program Records Management Policy is currently in the works. For an update on its status and a preview of what it will involve, be on the lookout for an article in the next issue of Rendezvous.*

How would you describe the difference in workforce focus between now and the period prior to the announcement of Constellation?

"You knew the shuttle program was ending, but now you can see that there is a future."

-MSFC

"Immediately after the President's Vision was communicated there were mixed feelings – happy for having a roadmap, but concerned about changes and the personal impacts to the end of a long program. Now, I'm seeing higher levels of personal concern as we are getting closer to the end."

-MAF

"There is a great deal of uncertainty in the entire community relative to transition. This is natural, and I believe that management is attempting to reduce this through the appropriate channels."

-JSC

"Our focus has always been human space flight. The new vehicle gives us a chance for us to use all the knowledge and know-how that we've been acquiring throughout the Apollo/shuttle/station eras."

-WSTF

What impact is Constellation currently having on your day-to-day work responsibilities?

"It seems that they are now getting to pick up their fair share of products and services, which, in the past, have been paid for by shuttle. Not to say that it is fair yet, but it's getting closer."

-MSFC

"The biggest impact occurs when we lose an experienced shuttle person to the Constellation program. Each task must be reviewed to decide if a replacement is required or if the workload can be redistributed among existing NASA/contractor resources. It's becoming difficult to get people to move into the shuttle program from other areas with the end of the Program in sight."

-JSC

"We are increasing our understanding of the new vehicle to enable a smoother transition of personnel."

-WSTF

"As significant portions of the program are having their preliminary design reviews, we're being asked to participate — either to provide information or to actually serve as reviewers or as board members."

-KSC

What's your biggest concern right now?

"Will Congress and the American people be happy with us having no way to get to the International Space Station?"

-MSFC

Rendezvous responds: *Although we won't be launching missions to the space station after the shuttle retires, the space station will be serviced by the Russians' Soyuz and Progress vehicles and, eventually, by the Orion crew exploration vehicle, which will be capable of carrying crew and cargo to the station.*

"The transition people tell us that they're retiring this stand and that launch pad, but they don't tell us about what they're doing with the people."

-MSFC

Rendezvous responds: *Program managers recently presented an initial report on workforce transition strategy to Congress. For a closer look at what the report said, take a look at Human Capital: Strategies for the Future in this issue. You can also read the report for yourself at www.nasa.gov/news/reports/index.html (April 1, 2008 – Workforce Transition).*

"Just how big is that gap or bath tub going to be, and how will it affect me?"

-SSC

"How are we going to keep a young workforce around during the gap when they're already programmed to be more mobile in regards to jumping jobs and changing careers than we were?"

-SSC

"During the gap years, when all we're doing is maintaining facilities and capabilities, how do we keep it interesting and engaging?"

-SSC

From Leadership

Shuttle retirement is real.

In the past few months, there has been a lot of discussion within the workforce and among the NASA stakeholders about the possibility of an 11th hour decision about flying the shuttle beyond 2010. There have been no changes to our marching orders. In fact, in the last couple of months, we have taken certain actions that ensure the planned retirement of the shuttle. While many of us believe that the space shuttle represents one of the great engineering achievements of all time, the belief that the shuttle will continue to fly beyond 2010 is unfounded. Here is why:

First, we have already made decisions regarding the termination of certain production capabilities for shuttle flight hardware. We have stopped procuring the raw materials for the external tanks assembled at the Michoud Assembly Facility. We have made decisions to terminate the production of the space shuttle main engines, which are built in Canoga Park, Calif., and tested at the Stennis Space Center. We have terminated several suppliers of orbiter flight components. Reversing those decisions and restarting production would have significant schedule impacts and would be increasingly cost prohibitive.

Second, we are well into the process of releasing major facilities to the Constellation Program. These include engine test stands at Stennis for J2X testing, critical floor space at Michoud for the development of the Ares I upper stage, high bays within the Vehicle Assembly Building and, after the launch of STS-125 (the Hubble Space Telescope reservicing mission), Launch Complex 39B at the Kennedy Space Center.

Third, continuing to fly the shuttle past 2010 will not shorten the duration of the gap between the last shuttle flight and the first crewed Ares flight. Instead, it can only postpone it. Why? Because parking the shuttle fleet is not only a logistical decision, it's a budgetary one. The shuttle program's annual budget of approximately $3 billion per year is money slated to be made available to the Constellation Program after 2010. If we continue to fly the shuttle past 2010, then we are effectively delaying virtually all of the critical Constellation Program milestones at a time when they are at the peak of their development cycle.

As of the publication of this issue of Rendezvous, we have 11 remaining flights on the shuttle manifest. Since shuttle retirement IS real, let us all commit to finish the race strongly. Let's assure the safety and success of each remaining mission. Let's focus at the tasks in front of us, prepare for our future and close out NASA's longest and most ambitious program on a high note. Let's go out a winner.

Lee Norbraten
Manager, Shuttle Transition Management Office
Johnson Space Center

From The Editor

Transition is real.

The retirement of the shuttle fleet and the end of the longest program in the agency's history is just around the corner. Understandably, this fact worries many of those who have dedicated their careers to the Space Shuttle Program and the assembly of the International Space Station.

But this is not the first time this has happened. Back in the late 1960s and early 1970s, the extended NASA workforce, who had grown up with a space race that took us to the moon, faced a similar scenario. So for this issue we talked to a number of fascinating program veterans around the sites who remember what that prior transition was like and could offer some words of wisdom we should take to heart. This feature article contrasts nicely with our regular Transition and Retirement Progress Report, which in this issue focuses on the ramp-up of Constellation activities around the agency.

We also cover the human capital side of transition with our story on NASA's initial report to Congress on the transition strategy for the space shuttle and constellation workforces.

We also talked to a couple of interesting folks. Our profiles of Mike Allen, Marshall's shuttle transition manager and Frank Duleba, a Pratt & Whitney Rocketdyne quality planning engineer at Stennis who is also quite involved with transition activities from the contractor side, bring transition into sharper focus from two different perspectives.

From this issue on, we are making a point of covering contractor-related issues as well as civil servant concerns. Our contractors, be they Lockheed Martin, Boeing, Alliant Techsystems, Jacobs Engineering, Pratt & Whitney Rocketdyne or a host of others who have dedicated their businesses and efforts to the past, present and future of human space flight and space exploration, deserve equal time and consideration in Rendezvous and equal access.

Finally, for our focus and brainstorming session (FABS) input for "Weighing In," we visited Marshall Space Flight Center and Stennis Space Center to talk to you. For our next issues, we are planning on visiting centers on both coasts, as well as tapping into what people are thinking about at Johnson Space Center. We'll be conducting FABS in these locations, but we'll also be interviewing people and researching pertinent and timely stories. If you have a story suggestion, or have run across an issue that you think should be addressed by Rendezvous that concerns any of these sites, or would like to host one of our FABS, please contact us. We look forward to hearing from you.

Enjoy!